

# First record of *Papillogobius melanobranchus* in the Mediterranean Sea and new data on geographic distributions, bathymetric ranges and morphology of several small benthic fishes in the Levant

by

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**ABSTRACT.** - *Papillogobius melanobranchus* (Fowler, 1934) is for the first time recorded in the Mediterranean Sea. Geographic distribution of several gobiid species in the Mediterranean Sea was extended in the Levant from the data on the identified specimens in the Fish Collection of the Hebrew University of Jerusalem and in the Zoological Museum of Tel-Aviv University and from the data on the collected species during fieldwork at Sedot Yam (Israel) in September 2006: *Coryogalops ochetica* (Norman, 1927); *Deltentosteus colonianus* (Risso, 1820); *Gobius fallax* Sarato, 1889; *Gobius geniporus* Valenciennes, 1837; *Pseudaphya ferrerii* (de Buen & Fage, 1908). In addition, several new bathymetric ranges have been established for small epibenthic and cryptobenthic species: *Gobius bucchichi* Steindachner, 1870; *Gobius cobitis* Pallas, 1814, *G. fallax*; *Parablennius zvonimiri* (Kolombatović, 1892); *Tripterygion tripteronotus* (Risso, 1810). Interesting morphological characters and bathymetric ranges for several of these species are discussed.

**RÉSUMÉ.** - Premier signalement de *Papillogobius melanobranchus* en mer Méditerranée et nouvelles données pour le Levant sur les distributions géographique et bathymétrique, et la morphologie d'espèces benthiques de petite taille.

*Papillogobius melanobranchus* (Fowler, 1934) est signalé pour la première fois en mer Méditerranée. La distribution géographique de plusieurs espèces de gobies, *Coryogalops ochetica* (Norman, 1927); *Deltentosteus colonianus* (Risso, 1820); *Gobius fallax* Sarato, 1889, *Gobius geniporus* Valenciennes, 1837; *Pseudaphya ferrerii* (de Buen & Fage, 1908); *Papillogobius melanobranchus* (Fowler, 1934), en Méditerranée a été élargie au Levant à partir de spécimens identifiés dans la Collection de Poissons de l'Université hébraïque de Jérusalem et dans celle du Musée zoologique de l'université de Tel Aviv ainsi que de spécimens collectés durant un échantillonnage à Sedot Yam (Israël) en Septembre 2006 : de nouvelles distributions bathymétriques ont été établies pour certaines petites espèces épi- et cryptobenthiques : *Gobius bucchichi* Steindachner, 1870; *Gobius cobitis* Pallas, 1814, *G. fallax*; *Parablennius zvonimiri* (Kolombatović, 1892); *Tripterygion tripteronotus* (Risso, 1810). D'intéressantes données morphologiques ainsi que certaines distributions bathymétriques sont discutées.

**Key words.** - Gobiidae - *Papillogobius melanobranchus* - MED - Geographical distributions - Morphology - Bathymetric ranges - First record.

The first checklist of the Mediterranean fishes of the Eastern Levant was composed by Gruvel (1931), who reported a total of 95 species; however, he did not specify the number of gobies that were among them. The first comprehensive study of this area was conducted by Ben-Tuvia (1953), listing 211 species, of which only five were gobies. Similarly, only three gobies were reported by Demetropoulos and Neocleous (1969) among the 196 fish species of Cyprus. P.J. Miller of Bristol University can be credited with identifying gobies in the collection of the Sea Fisheries Research Station, Haifa and in the Hebrew University Fish Collection, Jerusalem and thus increasing the number of known gobies in the region to 14, among the total of 284 species in the revised list of the Mediterranean fishes of Israel (Ben-Tuvia, 1971). However, Mouneimne list of the Mediterranean fishes of Lebanon (1977) mentioned only eight gobies out of a total of 218. The most recent ichthy-

ofaunistic list of eastern Levantine fish (Golani, 1996) enumerated 410 species, of which 23 are gobies, among them three of Red Sea origin (Lessepsian migrants). The known Levantine gobiid fauna significantly increased recently due to the findings of Kovačić and Golani (2006, 2007). These findings called attention to the possibility that more intensive work on small epibenthic and cryptobenthic fishes of the Levant could provide new and interesting results for these species in the less researched south-eastern area of the Mediterranean.

The aim of the present paper is to provide data on the first record of *Papillogobius melanobranchus* (Fowler, 1934) and on the extended geographic distribution of several gobiid species in the Levant based on the identified specimens in the Fish Collection of the Hebrew University of Jerusalem and in the Zoological Museum of Tel-Aviv University and on the collected species during fieldwork at

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Sedot Yam (Israel) in September 2006. In addition, new bathymetric ranges have been established for several small epibenthic and cryptobenthic fishes.

## MATERIALS AND METHODS

The examined material is deposited in the Hebrew University of Jerusalem (HUJ), in Tel-Aviv University (TAU) and in the Prirodoslovni muzej Rijeka (PMR). The data on all used material is listed for each species in the Results. The part of the samples was collected during recent fieldwork at Sedot Yam (Israel) (Fig. 1) in September 2006. On this fieldwork small epibenthic and cryptobenthic species were collected by the scuba diving using rotenone. The old material in the collections was identified for the first time or previous wrong identifications were reidentified. Identification was carried out by one of us (MK) using identification keys and species descriptions (Miller, 1986; Gill and Miller, 1990; Hoese, 1991; Gill, 1993; Ahnelt and Dorda, 2004; Kovačić,

2005 and references therein). Head lateral line system was checked under binocular. When necessary, the specimens were stained in 2% KMnO<sub>4</sub> solution for 20 s and 0.3% H<sub>2</sub>SO<sub>4</sub> solution for 20 s for better examination of sensory papillae rows. The diagnoses are minimum combination of characters that positively identify researched specimens among species of these family in the Clofnam area (Miller, 1986; Ahnelt and Dorda, 2004; Kovačić, 2005 and references therein), except for *P. melanobranchus* (Fowler, 1934), where generic diagnosis identifies the genus among known related genera of the subfamily Gobiinae worldwide (Gill and Miller, 1990; Gill, 1993) and species diagnosis identifies the species among all congeneric species (Gill and Miller, 1990; Hoese, 1991). The generic and species identification of *P. melanobranchus* was confirmed by H.S. Gill (pers. comm.). The short morphological descriptions were provided for the new zoogeographic records of fishes and an unusual depth occurrence of *G. cobitis*. Morphometric and meristic methods follow Miller (1988). Meristic abbreviations: A, anal fin; C, caudal fin; D, dorsal fins; P, pectoral fin; V, pelvic disc; LL, scales in lateral series; TR, scales in transverse series. Terminology of lateral-line system follows Sanzo (1911) and Miller (1986).

## RESULTS

### Gobiidae

#### *Coryogalops ochetica* (Norman, 1927)

**Material examined.** - 1 male, 33.7 + 8.8 mm, HUJ 13452, Bardawil Lagoon, Northern Sinai, Egypt, 12 Apr. 1969 (Fig. 2).

**Diagnosis.** - (1) suborbital papillae of lateral-line system without longitudinal row *a*; (2) all three head canals present; (3) anterior-dorsal row *g* ends behind lateral end of row *o*; (4) 7 suborbital transversal rows; (5) single transversal suborbital row below longitudinal row *b*.

**Description.** - Body moderately elongate, laterally compressed at caudal peduncle. Head slightly depressed. Snout with gently oblique profile. Anterior nostril with triangular flap. Angle of jaws ending below mid eye. Fins: D1 VI, D2 I/10, A I/9, C 15 articulated rays, 12 branched, P 15 (both sides), V I/5+5/I. Upper P rays free from membrane. V complete, rounded; anterior membrane without lateral lobes. C rounded. Body with ctenoid scales, LL 29 (both sides), TR 9

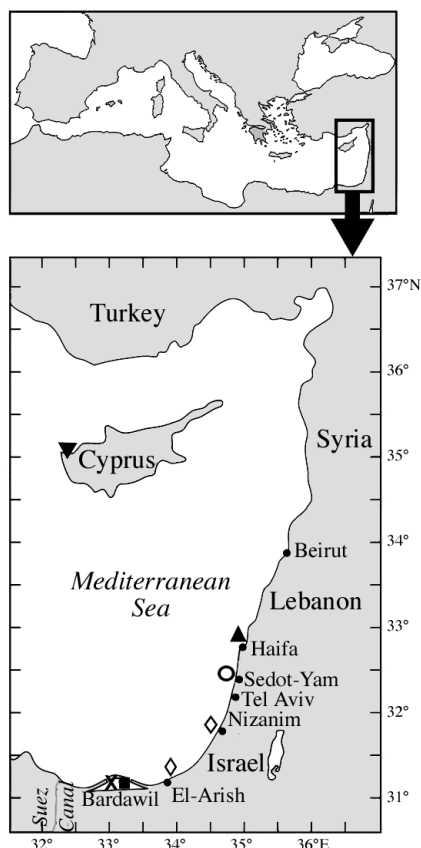


Figure 1. - Map of the Mediterranean and the eastern Levant showing new records of *Coryogalops ochetica* (×), *Deltentosteus colanianus* (▲), *Gobi fallax* (○), *Gobi geniporus* (▼), *Papillogobius melanobranchus* (■), *Pseudaphya ferreri* (◇). [Carte de la mer Méditerranée et du Levant oriental montrant les nouvelles signalisations.]



Figure 2. - *Coryogalops ochetica* (Norman, 1927), male, 33.7 + 8.8 mm, HUJ 13452, Bardawil lagoon, Northern Sinai, Egypt, 12 Apr. 1969. Scale bar = 5 mm.

(both sides). Predorsal area, including nape, opercle, cheek and breast naked. The preserved specimen was yellowish brown. The most distinct pattern was brown marks along lateral midline, beginning with triangular one on caudal peduncle near origin of C. Head similar to body, with brown spots above upper edge of opercle and on cheek, underside of head with row of regular spots. D1 with broadband in the middle of the fin; D2, A and C pigmented; P with two brown marks near upper and lower fin origin; V whitish. Head with anterior and posterior oculoscapular, and preopercular canals, with pores  $\sigma$ ,  $\lambda$ ,  $\kappa$ ,  $\omega$ ,  $\alpha$ ,  $\beta$ ,  $\rho$ ,  $\rho^1$ ,  $\rho^2$ , and  $\gamma$ ,  $\delta$ ,  $\epsilon$  respectively. Rows: 7 transverse suborbital rows (1-7) of sensory papillae; 4 transversal rows before row *b* and single transversal suborbital row below longitudinal row *b*; 2 and 3 begin more distant from orbit than row 4; suborbital row under longitudinal row *b* descending below the level of row *d*. Longitudinal row *b* extending forward to row 5. Longitudinal row *d* continues. Oculoscapular anterior longitudinal row  $x_1$  ending anteriorly behind pore  $\beta$ . Anterior dorsal row *n* behind pore  $\omega$  short, transversal. Anterior dorsal row *g* ending behind row *o*.

**Remarks.** - *C. ochetica* was described by Norman (1927) as assigned to the genus of *Gobius* from seven specimens from Port Said, Egypt. It was considered to be a Lessepsian migrant since its distribution included only the Red Sea and the Isthmus of Suez (Golani *et al.*, 2006). It inhabits shallow water, isolated hard substrate but found occasionally on sandy substrate (Goren, 1985). The present record, from the Bardawil Lagoon constitutes the first Mediterranean record of this species out of the Suez Isthmus (Fig. 1).

*Deltentosteus colonianus* (Risso, 1820)

**Material examined.** - 1 female, 51.9 + 9.3 mm, HUJ 19459, Haifa Bay, Israel, 25 Feb. 2006 (Fig. 3).

**Diagnosis.** - (1) suborbital papillae of lateral-line system with longitudinal row *a*; (2) V with anterior membrane; (3) head canals present, and with numerous extra pores; (4) D2 I/10, AI/10.

**Description.** - Body subcylindrical, laterally compressed at caudal peduncle. Snout moderately large, with slightly sloping profile. Anterior nostril short, tubular, lacking process from rim. Eyes large. Mouth oblique. Large, caniniform teeth in jaws visible. Branchiostegal membrane not attached along entire lateral margin of isthmus, ending anterior behind preopercle. Fins: D1 VI, D2 I/10, A I/10, C 15 articu-



Figure 3. - *Deltentosteus colonianus* (Risso, 1820), female, 51.9+9.3 mm, HUJ 19459, Haifa bay, Israel, 25 Feb. 2006. Scale bar = 5 mm.

lated rays, 12 branched, P 17 (both sides), V I/5+5/I. Interdorsal space broad. Upper P rays within membrane. V complete, with anterior membrane. Body with ctenoid scales, LL 35 (both sides), TR 9-10. Predorsal area, including nape, and breast scaled. Opercle and cheek naked. The preserved specimen was yellowish white. Upper part of body with reticulate pattern, formed by dark pigment along the scale margins. The most distinct pattern was dark marks beginning with triangular one on caudal peduncle near origin of C, three rounded marks along lateral midline, and the forth, oblong, most anterior and below level of lateral midline. Head and chin similar to body, pigmented. Remaining underside of head and body whitish. D1, D2, A and C pigmented; P slightly pigmented; V whitish. Head with anterior and posterior oculoscapular, and preopercular canals, all expanded and with numerous extra pores. Suborbital papillae of lateral-line system with longitudinal row *a*. Suborbital rows without transverse proliferation.

**Remarks.** - *D. colonianus* was known from the eastern Atlantic coast of Portugal. In the Mediterranean it was known from the western basin to the Adriatic Sea. Antalya Bay, Turkey was the furthest eastern location previously recorded (Golani, 1996). Therefore the present record constitutes a considerable extension of its distribution (Fig. 1). This species inhabits algae meadows in shallow waters but, according to Miller (1986), some records from 120 m have been reported.

*Gobius bucchichi* Steindachner, 1870

**Material examined.** - 3 females, 45.4 + 10.6 mm to 49.6 + 11.9 mm, 2 males, 42.3 + 10.0 mm and 50.0 + 11.1 mm, PMR VP1566, Sedot Yam, Israel, 19 Sep. 2006.

**Diagnosis.** - (1) suborbital papillae of lateral-line system without longitudinal row *a*; (2) all three head canals present; (3) 6 suborbital transversal rows; (4) suborbital row *d* divided; (5) anterior oculoscapular canal with pore  $\alpha$  at rear of orbit; (6) oculoscapular row  $x^1$  not extending forwards to pore  $\beta$ ; (7) LL = 54-56; (8) pelvic disc oblong; (9) anterior membrane without lateral lobes.

**Remarks.** - *G. bucchichi* is present from the Mediterranean and the Atlantic coast of Southern Portugal and Morocco (Miller, 1986). It inhabits soft substrate near rocks and gravel to depth of 6 m. The present record at rocky reef at 10-12 m depth constitutes an extension of its bathymetrical distribution.

*Gobius cobitis* Pallas, 1814

**Material examined.** - 1 female, 110.0 + 24.1 mm, TAU 12252, Israeli coast Palmahim, Israel, 03 Jun. 2000 (Fig. 4).

**Diagnosis.** - (1) suborbital papillae of lateral-line system without longitudinal row *a*; (2) all three head canals present; (3) no suborbital transversal row near pore  $\alpha$ ; (4) anterior ocu-

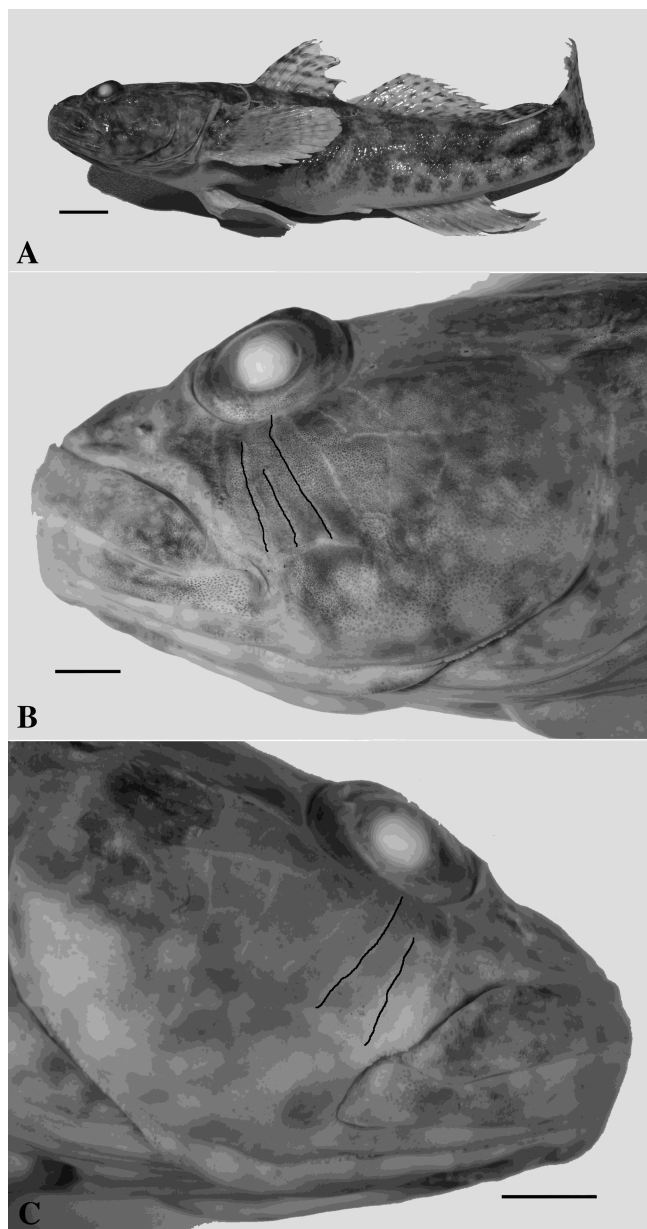


Figure 4. - *Gobioides cobitis* Pallas, 1814, female, 110.0 + 24.1 mm, TAU 12252, Israeli coast Palmahim, Israel, 3 Jun. 2000. **A:** Left lateral view, scale bar = 10 mm; **B:** Left side of head with lateral-line sensory papillae visible, suborbital rows 2, 3 and additional one in between marked, scale bar = 3 mm; **C:** Right side of head with lateral-line sensory papillae visible, suborbital rows 2 and 3 marked. Scale bars = 3 mm. [G. cobitis. **A:** Vue latérale gauche, échelle = 10 mm ; **B:** Côté gauche de la tête montrant la ligne latérale de papilles sensorielles, rangées suborbitales 2, 3 marquées et une supplémentaire intercalée, échelle = 3 mm ; **C:** Côté droit de la tête montrant la ligne latérale de papilles sensorielles, rangées suborbitales 2, 3 marquées. Échelles = 3 mm.]

loscapular canal with pore  $\alpha$  at rear of orbit; (5) oculoscapular row  $x^1$  not extending forwards to pore  $\beta$ ; (6) LL = 59-60; (7) pelvic disc rounded; (8) anterior membrane with lateral lobes.

**Description.** - Body moderately elongate, laterally compressed towards caudal fin. Head depressed. Snout with gently oblique profile. Anterior nostril with long digitate process from rim. Mouth oblique. Angle of jaws ending below mid eye. Branchiostegal membrane attached along entire lateral margin of isthmus from immediately anterior to pectoral margin. Fins: D1 VI, D2 I/13, A I/10, C 16 articulated rays, 14 branched, P 20-21, V I/5+5/I. P with ends of four uppermost rays free from membrane. V complete, rounded; anterior membrane with lateral lobes. C rounded. Trunk with ctenoid scales, LL 59-60, TR 16 (both sides). Predorsal area, including nape, opercle and breast scaled. Cheek naked. Upper and lateral parts of body of the preserved specimen mottled dark brown and yellowish brown. Dark brown blotches and black dots along lateral midline. Underside of body yellowish white. Head mottled similar to body, isthmus yellowish white. D1 with four longitudinal brown bands. D2, C and P with irregular rows of brown spots. A pale at origin, grey on distant part of fin. V yellowish white. Head with anterior and posterior oculoscapular, and preopercular canals, with pores  $\sigma$ ,  $\lambda$ ,  $\kappa$ ,  $\omega$ ,  $\alpha$ ,  $\beta$ ,  $\rho$ ,  $\rho^1$ ,  $\rho^2$ , and  $\gamma$ ,  $\delta$ ,  $\epsilon$  respectively. Pore  $\alpha$  at rear of orbit. No suborbital row at pore  $\alpha$ ; 6 transverse suborbital rows (1-6) of sensory papillae on right side; 4 transversal rows before row  $b$ , 2 transversal suborbital rows below longitudinal row  $b$ , aberration on left side with additional row between rows 2 and 3 distant from orbit i.e. 5 rows before row  $b$ . Row 2 begins more distant from orbit than row 3 and 4; suborbital row  $\delta i$  under longitudinal row  $b$  descending below the level of row  $d$ . Longitudinal row  $b$  extending forward to or slightly in front of row 5. Longitudinal row  $d$  continues, reaching  $\delta i$  backwards. Snout with five median preorbital series as clusters, two  $r$  above pore  $\sigma$ , three  $s$  between pore  $\sigma$  and upper lip. Oculoscapular anterior longitudinal row  $x_1$  ending anteriorly behind pore  $\beta$ . Anterior dorsal row  $g$  ending on row  $o$  on the right side, and on the left side  $g$  ending behind row  $o$ . Row  $o$  (15-20) separated from fellow in dorsal midline.

**Remarks.** - *G. cobitis* is the largest member of its family in the eastern Levant, reaching 25 cm TL. It has Atlanto-Mediterranean distribution with two specimens whose source is dubious from the Gulf of Suez (Goren and Klauswitz, 1978). It inhabits rocky substrate to depths of 10 m (Miller, 1986). Therefore the present record of this species collected from depth of 35 m constitutes a considerable extension of its bathymetrical distribution.

#### *Gobioides fallax* Sarato, 1889

**Material examined.** - 1 male, 38.3 + 7.6 mm, HUJ 19553, Sedot Yam, Israel, 20 Sep. 2006 (Fig. 5).

**Diagnosis.** - (1) suborbital papillae of lateral-line system without longitudinal row  $a$ ; (2) all three head canals present; (3) 6 suborbital transversal rows and a single papilla present near pore  $\alpha$ ; (4) suborbital row  $d$  divided; (2) LL 45-46; (3)

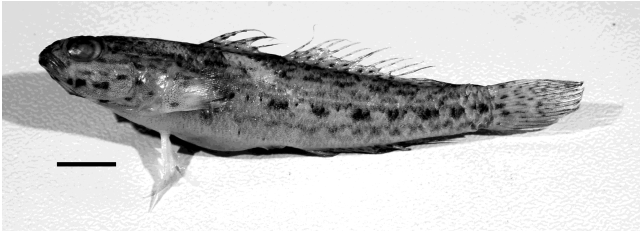


Figure 5. - *Gobioides fallax* Sarato, 1889, male, 38.3 + 7.6 mm, HUJ 19553, Sedot Yam, Israel, 20 Sep. 2006. Scale bar = 5 mm.

V emarginated 1/5 of its length (vs 1/2-2/3 in *Gobioides auratus*); (4) preserved specimen with blotches along lateral midline (vs *Gobioides xanthocephalus* without blotches along lateral midline); (5) benthic behaviour (vs behaviour of *Gobioides auratus*); (6) D I/13, A I/12 (vs D I/14-15, A I/13-15 in *Gobioides xanthocephalus*).

**Description.** - Body moderately elongate, laterally compressed. Head moderately depressed. Snout with oblique profile. Anterior nostril with triangular flap. Mouth oblique. Angle of jaws ending below anterior part of pupil. Branchiostegal membrane attached along entire lateral margin of isthmus from immediately anterior to pectoral margin. Fins: D1 VI, D2 I/13, A I/12, C 15 articulated rays, 13 branched, P 18-19, V I/5+5/I. P with free uppermost rays moderately developed. V truncate, with reduced anterior membrane. C rounded. Trunk with ctenoid scales, LL 45-46, TR 12 (both sides). Predorsal area, including nape, opercle and breast scaled. Cheek naked. Preserved specimen was pale yellow with greyish brown pigmentation. The most distinct pattern was 8 oblong blotches, wider than deep, along lateral midline; upper part of body with spots, sometimes forming irregular longitudinal rows; underside whitish. Head similar to body, three well defined spots on cheek, the most anterior one extending on angle of jaws, three pairs of geniohyoid spots, and anteriorly from them U-shaped mark. Fins membranes damaged. However, grayish brown spots visible on D1, D2 and C. P and V poorly pigmented, whitish. P base with larger dark mark in upper part and smaller one in lower part. Head with anterior and posterior oculoscapular, and preopercular canals, with pores  $\sigma$ ,  $\lambda$ ,  $\kappa$ ,  $\omega$ ,  $\alpha$ ,  $\beta$ ,  $\rho$ ,  $\rho^1$ ,  $\rho^2$ , and  $\gamma$ ,  $\delta$ ,  $\varepsilon$  respectively. Pore  $\alpha$  at rear of orbit. Rows: six transverse suborbital rows (1-6) of sensory papillae and a single papilla present near pore  $\alpha$ ; rows 2 and 3 begin more distant from orbit than row 4; 4 transversal rows before row b, 2 transversal suborbital rows below longitudinal row b; suborbital row 6i descending to the level of row d. Longitudinal row b extending forward to row 5, ending below rear of orbit. Longitudinal row d divided between rows 3 and 4, ending backwards near 6i. Oculoscapular anterior longitudinal row  $x_1$  ending anteriorly behind pore  $\beta$ . Anterior dorsal row g ending behind lateral part of row o, row o separated from fellow in dorsal midline.

**Remarks.** - *G. fallax* was known previously to this report from the western basin of the Mediterranean to the Aegean Sea, as well as from the Canaries Islands (Miller, 1986). Recently Kovačić and Golani (2007) reported it from Cyprus. The species inhabits sandy substrate in close proximity to rocks, often with algae at depths to 10 m. The present report extends its distribution to the most eastern shore of the Mediterranean and the collection at 30 m greatly extends its bathymetrical range (Fig. 1).

#### *Gobius geniporus* Valenciennes, 1837

**Material examined.** - 1 female, 80.8 + 18.3 mm, HUJ 8713, Krsokou Bay, eastern of Bath of Aphrodita, Cyprus, 19 Oct. 1969 (Fig. 6).

**Diagnosis.** - (1) suborbital papillae of lateral-line system without longitudinal row a; (2) all three head canals present; (3) 6 suborbital transversal rows; (4) suborbital row d divided; (5) anterior oculoscapular canal with pore  $\alpha$  at rear of orbit; (6) oculoscapular row  $x^1$  not extending forwards to pore  $\beta$ ; (7) LL 55; (8) pelvic disc truncate; (9) anterior-dorsal row g ends behind lateral end of row o.

**Description.** - Body moderately elongate, laterally compressed. Head moderately depressed. Snout with oblique profile. Anterior nostril with triangular flap. Mouth oblique. Angle of jaws ending below anterior part of eye. Branchiostegal membrane attached along entire lateral margin of isthmus from immediately anterior to pectoral margin. Fins: D1 VI, D2 I/13, A I/12, C 13 branched rays, P 18-19, V I/5+5/I. P with ends of three uppermost rays free from membrane. V emarginated 1/5 of its length and with reduced anterior membrane. C rounded. Trunk with ctenoid scales, LL 55, TR 12 (both sides). Predorsal area, including nape, and breast scaled. Cheek and opercle naked. Upper and lateral parts of body of the preserved specimen mottled brown and light yellowish brown. The most distinct pattern was 5 oblong blotches, wider than deep, along lateral midline, with spots and lighter marks inbetween. Lower third of lateral side and underside of body yellow. Head coloured similar to body, two brown marks better defined on cheek, light spots with defined edges along posterior end of opercle underside of head, including chin yellow, head sensory papillae black.

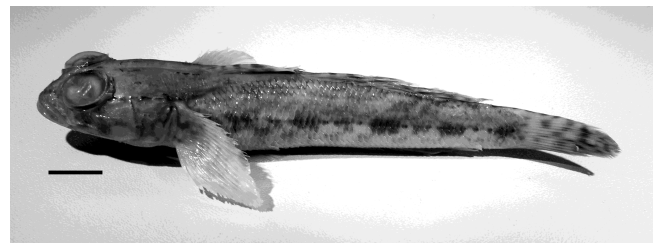


Figure 6. - *Gobius geniporus* Valenciennes, 1837, female, 80.8 + 18.3 mm, HUJ 8713, Krsokou Bay, eastern of Bath of Aphrodita, Cyprus, 19 Oct. 1969. Scale bar = 10 mm.

D1 with irregular longitudinal rows of brown spots, D2, C with brown spots. P with ill visible pigmented spots and light spots on P base. A pale at origin, light brown on distant part of fin. V yellowish white. Head with anterior and posterior oculoscapular, and preopercular canals, with pores  $\sigma$ ,  $\lambda$ ,  $\kappa$ ,  $\omega$ ,  $\alpha$ ,  $\beta$ ,  $\rho$ ,  $\rho^1$ ,  $\rho^2$ , and  $\gamma$ ,  $\delta$ ,  $\varepsilon$  respectively. Pore  $\alpha$  at rear of orbit. Rows: six transverse suborbital rows (1-6) of sensory papillae; all begin close to orbit, 4 transversal rows before row *b*, 2 transversal suborbital rows below longitudinal row *b*; suborbital row *6i* descending to the level of row *d*. Longitudinal row *b* extending forward in front of row 5. Longitudinal row *d* continues, ending backwards between vertical of rows *5i* and *6i*. Oculoscapular anterior longitudinal row  $x_1$  ending anteriorly behind pore  $\beta$ . Anterior dorsal row *g* ending behind lateral part of row *o*, row *o* separated from fellow in dorsal midline.

**Remarks.** - *G. geniporus* is endemic to the Mediterranean. Miller (1986) reported its distribution from the western basin to the Aegean Sea. The present record from Cyprus presents the further eastern location of its distribution range (Fig. 1). This inshore species inhabits sandy or rocky substrate at depths of up to 30 m.

*Papillogobius melanobranchus* (Fowler, 1934)

**Material examined.** - 1 male, 34.1 + 8.6 mm, HUJ 13803, Bardawil lagoon, Northern Sinai, Egypt, 15 May 1978 (Fig. 7).

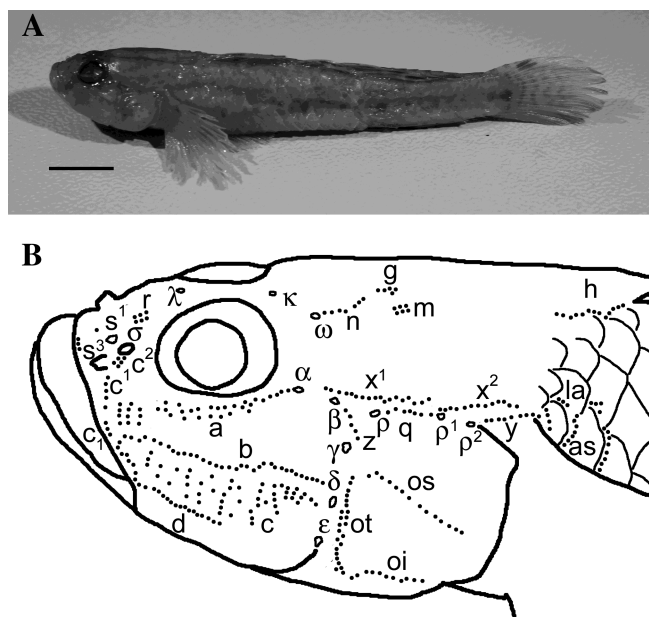


Figure 7. - *Papillogobius melanobranchus* (Fowler, 1934), male, 34.1 + 8.6 mm, HUJ 13803, Bardawil lagoon, Northern Sinai, Egypt, 15 May 1978: **A**: Left lateral view, scale bar = 5 mm; **B**: Head lateral-line sensory papillae and canal pores, see terminology in text. [*P. melanobranchus*. **A** : Vue latérale gauche, échelle = 5 mm ; **B** : Papilles sensorielles et pores des canaux latéraux de la tête, voir terminologie dans le texte.]

**Generic diagnosis.** - (1) snout steep; (2) mouth oblique; (3) head short ( $H/SL = 24.6\%$ ); (4) suborbital rows of lateral-line system *a* and *c* transversely proliferated; (5) suborbital rows *b* long and single; row *d* single; (6) anterior-dorsal row *n* longitudinal; (7) preoperculo-mandibular *e* single; (8) opercle and preopercle without scales and spines; (9) D I and A I not strengthened.

**Diagnosis.** - (1) body scales to above end of opercle; (2) prepelvic naked anteriorly, scales in 3 rows; (3) branchiostegal membranes meet on isthmus below rear of opercle; (4) oculoscapular rows  $x^1$  and  $x^2$  separate; (5) preoperculo-mandibular *e* more or less continuous with very small gap of one or two papilla; (6) predorsal area naked.

**Description.** - Body moderately elongate, laterally compressed. Head depressed and short ( $H/SL = 24.6\%$ ). Snout with moderately sloping profile. Anterior nostril short, tubular, lacking process from rim. Eyes dorso-lateral, relatively small. Mouth oblique. Angle of jaws ending below anterior part of eye. Fins: D1 VI, D2 I/8, A I/8, C 14 articulated rays, 12 branched, P 15 (both sides), V I/5+5/I. Upper P rays within membrane. V complete, rounded; anterior membrane well developed, with straight rare edge and without lateral lobes. C rounded. Body with large ctenoid scales, LL 28 (both sides), TR 7 (both sides). Predorsal area, including nape, naked, scales reaching line between above end of opercle and anterior beginning of D1. Opercle and cheek naked. Breast anteriorly naked, with three rows of cycloid scales posteriorly. The preserved specimen was yellowish brown. The most distinct pattern was four brown marks along lateral midline, beginning with one on caudal peduncle near origin of C, with lighter marks and spots between. Upper part of the body gently pigmented, marbled. Head similar to body, with slightly brown preorbital bar and mark on upper anterior part of opercle. Underside of body without pigmentation, except dusky area of membrane around isthmus. D1 mostly dark, pale only along the upper end of the fin. D2 spotted brown, with large distinct spots between upper part of rays. A and V pigmented. C spotted brown, with the most distinct spot on anterior dorsal part. P poorly pigmented, with brown mark near upper fin origin. Head with anterior and posterior oculoscapular, and preopercular canals, with pores  $\sigma$ ,  $\lambda$ ,  $\kappa$ ,  $\omega$ ,  $\alpha$ ,  $\beta$ ,  $\rho$ ,  $\rho^1$ ,  $\rho^2$ , and  $\gamma$ ,  $\delta$ ,  $\varepsilon$  respectively. Rows (papillae counted on the left side): (I) preorbital: snout in median preorbital series with upper row *r* as cluster (6) between pores  $\sigma$  and  $\lambda$ ; upper row  $s^1$  as single papilla near pore  $\alpha$ , and lower row  $s^3$  as horizontal row above upper lip (3). Lateral series *c* in three parts: superior ( $c^2$ ) as cluster below posterior nostril (5); middle transversal  $c^1$  (5) close to anterior nostril; inferior  $c_1$  (3) longitudinal above lips. (II) suborbital: row *a* with transversal disorganised proliferations, with width at anterior beginning of about 4 papillae, narrowing backwards and ending near pore  $\alpha$  as single row. Row *b* long and single, beginning between upper lip and eye, ending near edge of

preopercle. Row *c* with transversal disorganised proliferations, width at beginning above angle of jaws of about 3 papillae, reaching maximum width of about 7 papillae above posterior end of *d*, and ending near edge of preopercle as single row. Rows *d* single, ending backwards below anterior part of eye. (III) preoperculo-mandibular: external row *e* single and not clearly divided (55); internal row *i* divided into anterior (*i*<sup>1</sup>: 19), and posterior sections (*i*<sup>2</sup>: 24); mental row *f* clustered (7); (IV) oculoscapular: anterior longitudinal row *x*<sup>1</sup> (18) separate from posterior longitudinal row *x*<sup>2</sup> (13); row *z* (5) with lower end near pore *γ*; row *q* (7) longitudinal, beginning behind pore *ρ*; row *y* longitudinal (8-14) behind pore *ρ*<sup>2</sup>; transversal axillary rows *as*<sup>1</sup> (5), *as*<sup>2</sup> (8), *as*<sup>3</sup> (10) present, longitudinal rows *la*<sup>1</sup> (3) and *la*<sup>2</sup> (4) present as variably scattered papillae between and above upper parts of rows *as*. (V) opercular: transverse row *ot* with doubled central part (23); superior longitudinal row *os* (14); and inferior longitudinal row *oi* (10). (VI) anterior dorsal: row *n* behind pore *ω* single and longitudinal. Row *g* (5) disorganised; row *m* (6) clustered; row *h* longitudinal (13).

**Remarks.** - *P. melanobranchus* is an Indo-West Pacific species not recorded in the Red Sea (Hoese, 1991). The present record from the Bardawil Lagoon constitutes the first record in the Mediterranean of this species (Fig. 1).

*Pseudaphya ferrerii* (de Buen & Fage, 1908)

**Material examined.** - 1 female, 17.3 mm, C damaged, HUI 19457, El-Arish, Northern Sinai, Egypt, 29 Oct. 1968 (Fig. 8); 1 male, 17.7 + 2.5 mm, TAU 1987(5), Nizanim, Israel, 28 Feb. 1987.

**Diagnosis.** - (1) suborbital papillae of lateral-line system with longitudinal row *a*; (2) V with anterior membrane; (3) head canals present; (4) transverse suborbital rows present; (5) anterior oculoscapular canal ending between eyes at paired pore *λ* and (6) LL ≤ 30.

**Description.** - Body subcylindrical, laterally compressed at caudal peduncle. Head slightly depressed. Snout moderately large, frontally ending in the level of pupil. Anterior and posterior nostrils pore like, with raised edges. Eyes large. Mouth oblique. Angle of jaws ending below pupil. Branchiostegal membrane attached just at anterior end of isthmus. Fins: D1 V-VI, D2 I/10, A I/9, C rays damaged on



Figure 8. - *Pseudaphya ferrerii* (de Buen & Fage, 1908), female, 17.3 mm, C damaged, HUI 19457, El-Arish, Northern Sinai, Egypt, 29 Oct. 1968. Scale bar = 2 mm.

both specimens, P 15 (both sides), V I/5+5/I. Interdorsal space broad. Upper P rays within membrane. V complete, with anterior membrane. Body with ctenoid scales, LL 29-30, TR 7 (both sides). Predorsal area scaled to opposite rear edge of opercle. Breast with cycloid scales. Opercle and cheek naked. The preserved specimens were pale orange yellow. The most distinct pattern was triangular dark mark on caudal peduncle extending on C rays and six dark dots along lateral midline. Pigment rarely scattered along dorsal fins, on head and slightly denser on lips. Fins unpigmented, except C mark. Head with anterior oculoscapular, and preopercular canals. Anterior oculoscapular canal ending anteriorly between eyes, at doubled pore *λ*, with single pore *κ* and pores *ω*, *α*, *β*, and *ρ*. Preopercular canal with pores *γ* and *ε*. Suborbital papillae of lateral-line system with longitudinal row *a*. Transverse suborbital rows present.

**Remarks.** - *P. ferrerii* is endemic to the Mediterranean (Miller, 1986). Until this report it was known from the northern shores of the western basin and the Adriatic Sea. The present records from Israel and northern Sinai, Egypt, greatly extends its distribution range (Fig. 1). *P. ferrerii* is a small nektonic species found also in sandy shores.

### Blenniidae

*Parablennius zvonimiri* (Kolombatović, 1892)

**Material examined.** - 8 specimens of unidentified sex, 26.3 + 5.0 mm to 40.2 + 6.6 mm, PMR VP1567, Sedot Yam, Israel, 19 Sep. 2006.

**Diagnosis.** - (1) gill membranes united forming fold across isthmus; (2) without well-developed, unpaired tentacle on nape followed by several smaller tentacles; (3) supraorbital tentacles present; (4) dorsal fin with distinct notch between spinous and soft part; (5) body with 5-7 white spots along base of D and a distinct dark spot on base of C.

**Remarks.** - *P. zvonimiri* is endemic to the Mediterranean and the Black Sea. It is very common along the Israeli shores in rocky habitats, inhabiting holes, crevices and other dimly lit environment. It was known hitherto at a maximum depth of 6 m (Zander, 1986a), therefore the present collection from 10-12 m increases its bathymetric range.

### Tripterygiidae

*Tripterygion tripteronotus* (Risso, 1810)

**Material examined.** - 5 specimens of unidentified sex, 25.4 + 5.6 mm to 38.2 + 7.6 mm, PMR VP1568, Sedot Yam, Israel, 19 Sep. 2006.

**Diagnosis.** - (1) the profile of head more obtuse with an arch of about 70°, lips not protruding; (2) dark bar on caudal peduncle with straight back edge, not forming an extension onto base of caudal fin.

**Remarks.** - *T. tripteronotus* is endemic to the Mediterranean and the Black Sea. It inhabits caves and crevices in rocky substrate. Previously it was known not deeper than

6 m (Zander, 1986b). Therefore the present collection from 10-12 m extends its known bathymetrical distribution.

## DISCUSSION

The most interesting finding of this research is the record of the Indo-Pacific species *P. melanobranchus* from the Bardawil Lagoon. The unique pattern of suborbital papillae of *Papillogobius* species among known genera of the subfamily Gobiinae (Gill and Miller, 1990) resembles that found in only one species of *Oplopomus* Valenciennes 1837: *O. oplopomus* (Valenciennes 1837) (Akihito and Yoshino, 1984; Goren, 1988). This unique pattern of suborbital papillae, in addition with characters included in generic diagnosis that differ from the description of *O. oplopomus* (e.g., D I and A I not strengthened) (Goren, 1979; Akihito & Yoshino, 1984) positively identifies this Indo-Pacific genus. Among four known *Papillogobius* species (Gill and Miller, 1990), only two have reached the western Indian Ocean, *P. melanobranchus* (Fowler, 1934) and *P. reichei* (Bleeker, 1853), *P. punctatus* Gill & Miller, 1990 is restricted to the eastern Indian Ocean and *P. exquisitius* Whitley, 1950, to the south-western Pacific. It could be expected that via the Suez Canal *P. reichei* would have entered the Mediterranean, the only species of this genus present in the Red Sea (Goren, 1988). However, diagnostic characters identify the specimen from the Bardawil Lagoon among four congeneric species as *P. melanobranchus* (Gill and Miller, 1990; Hoese, 1991) and species identification was confirmed by H.S. Gill (pers. comm.).

Positive differential diagnosis based on morphological characters that would assure the identification of any individual specimen does not exist for *G. auratus*, *G. fallax* and *G. xanthocephalus* as part of the *G. auratus* species group (Herler *et al.*, 2005; Kovačić and Golani, 2007). However, the present specimen of *G. fallax* differs from *G. xanthocephalus* and from *G. auratus* by several characters listed in the diagnosis.

Morphological peculiarities were observed in the present research on two species. The specimen TAU 1987(5) of *P. ferreri* had D1 with six spinous rays, contrary to five spinous rays in D1 known for this species. The aberration on the left side with an additional row between rows 2 and 3 distant from orbit i.e. 5 rows before row *b* and total of 7 suborbital rows was present on the specimen of *G. cobitis*. This aberration effects the usual identification of Mediterranean Gobiidae, since 6 suborbital rows is the diagnostic character for the genus *Gobius* in most identification keys for the Mediterranean (Miller, 1986).

The findings of the present study increase the total number of the known Levantine gobiid species to 29 species.

However, this is still a much lower level of biodiversity when compared to entire Mediterranean where 59 gobiid species have been recorded to date or areas of the Mediterranean such as the Adriatic Sea with 46 known gobiid species (Kovačić, 2005). Among known Levantine gobiid fauna, only four exotic species as well as *Didogobius bentu* - *vii* Miller, 1966 are not present in the northern Mediterranean.

It has been suggested by Goren and Galil (1997) in their study of deep water species that due to the distinctive hydrological and geological conditions in the Levant, certain species are able to increase their bathymetrical distribution in this region, as opposed to other areas of the Mediterranean. In our present study, we report five extensions of bathymetrical distribution of *G. buccichi*, *G. cobitis*, *G. fallax*, *P. zvonimiri* and *T. tripteronotus*; there may be a parallel depth extension in shallow water fish species. However, more material from various depths must be collected prior to substantiation of this phenomenon. Noteworthy is the finding of *G. cobitis* collected from the depth of 35 m.

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